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10/610,961	07/01/2003	Anand A. Kekre	VRT0063US	4162

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/610,961	KEKRE ET AL.	
	Examiner	Art Unit	
	Mahesh H. Dwivedi	2168	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 March 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-13,15,18-26,30 and 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-13,15,18-26,30 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Remarks

1. Receipt of Applicant's Amendment filed on 03/14/2007 is acknowledged. The amendment includes amending the specification, the cancellation of claims 2-3, 14, 16-17, and 27-29, the amending of claims 1, 5-9, 13, 15, 18-23, and 26, and the addition of claims 30-31.

Specification

2. The objections raised in the office action mailed on 12/12/2006 have been overcome by the applicant's amendments received on 03/14/2007.

Claim Rejections - 35 USC § 112

3. The rejections raised in the office action mailed on 12/12/2006 have been overcome by the applicant's amendments received on 03/14/2007.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 15, 31, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rand et al.** (U.S. PGPUB 2005/0108302) in view of **Milillo et al.** (U.S. Patent 6,643,671).

7. Regarding claim 1, **Rand** teaches a method comprising:

A) maintaining first and second data volumes (Paragraph 15, Figure 1);

C) refreshing the second data volume to the data contents of the first data volume that existed at time T (Paragraphs 30-31);

D) wherein refreshing the second data volume comprises overwriting all data of the second data volume with data of the first data volume that existed at time (Paragraphs 30-31);

E) modifying data of the first data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T (Paragraphs 6, 32, and 35).

The examiner notes that **Rand** teaches **"maintaining first and second data volumes"** as "As depicted in FIG. 1, data storage device 110 includes a primary data volume 112, and data storage device 120 includes a backup data volume 122. In the present exemplary embodiment, host system 102 writes/stores data on and reads/retrieves data from primary data volume 112. As described below, the data stored on primary data volume 112 is backed-up on data storage device 120 by storing the data written to primary data volume 112 on backup data volume 122" (Paragraph 15). The examiner further notes that **Rand** teaches **"refreshing the second data volume to the data contents of the first data volume that existed at time T"** as "Additionally, the data in backup data volume 122 can be stored in data blocks in data elements, where a map within a data element stores the association of a data block within the data element to a stamp that indicates when the data in the data block was written. Thus, the maps in data elements can be used to generate the image of primary data volume 112 at a specified point-in-time. In step 504 (FIG. 5), the generated image of primary data volume .112 is used to restore primary data volume 112 on data storage device 110" (Paragraphs 30-31). The examiner further notes that **Rand** teaches **"wherein refreshing the second data volume comprises overwriting all data of the second data volume with data of the first data volume that existed at time T"** as "Additionally, the data in backup data volume 122 can be stored in data blocks in data elements, where a map within a data element stores the association of a data block

within the data element to a stamp that indicates when the data in the data block was written. Thus, the maps in data elements can be used to generate the image of primary data volume 112 at a specified point-in-time. In step 504 (FIG. 5), the generated image of primary data volume .112 is used to restore primary data volume 112 on data storage device 110... If the entire primary data volume 112 needs to be restored, such as if data storage device 110 has failed, then the data associated with the generated image of primary data volume 112 can be restored from data storage device 120" (Paragraphs 30-31). The examiner further notes that **Rand** teaches **"modifying data of the first data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T"** as "Additionally, while the primary data volume is being restored, read/write requests to the primary data volume are satisfied using the generated image of the primary data volume" (Paragraph 6), "In step 506 (FIG. 5), while the primary data volume 112 is being restored, read and write requests for data in primary data volume 112 that have not been restored are satisfied using the generated image of primary data volume 112. For example, if host system 102 issues a read request for data that has not yet been restored to primary data volume 112, then the read request is satisfied by using the generated image of primary data volume 112" (Paragraph 32, and "In step 602, a determination is made as to whether the data storage drive having the primary data volume is active. If the data storage device is not active, then in step 604, the read/write requests to the primary data volume are satisfied using the generated image of the primary data volume" (Paragraph 35).

Rand does not explicitly teach:

B) wherein the first data volume is unrelated to the second data volume.

Milillo, however, teaches **"wherein the first data volume is unrelated to the second data volume"** as "In a PPRC system, volume pairs are designated in which a storage volume in the primary system is paired with a storage volume in the secondary system, which together may be referred to as an established PPRC volume pair" (Column 5, lines 56-60).

The examiner further note that it is common knowledge that in order for a PPRC volume pair to have volumes which become linked to one another, the volumes were initially unlinked to one another.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Milillo's** would have allowed **Rand's** to provide an improved system for improving the control for data synchronization, as noted by **Milillo** (Column 3, lines 41-48).

Regarding claim 15, **Rand** teaches a computer readable medium comprising:
A) refreshing a second data volume to the data contents of the first data volume that existed at time T (Paragraphs 30-31);
B) wherein refreshing the second data volume comprises overwriting all data of the second data volume with data of the first data volume that existed at time T (Paragraphs 30-31);
D) modifying data of the first data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T (Paragraphs 6, 32, and 35).

The examiner notes that **Rand** teaches **"refreshing a second data volume to the data contents of the first data volume that existed at time T"** as "Additionally, the data in backup data volume 122 can be stored in data blocks in data elements, where a map within a data element stores the association of a data block within the data element to a stamp that indicates when the data in the data block was written. Thus, the maps in data elements can be used to generate the image of primary data volume 112 at a specified point-in-time. In step 504 (FIG. 5), the generated image of primary data volume .112 is used to restore primary data volume 112 on data storage device 110" (Paragraphs 30-31). The examiner further notes that **Rand** teaches **"wherein refreshing the second data volume comprises overwriting all data of the second data volume with data of the first data volume that existed at time T"** as "Additionally, the data in backup data volume 122 can be stored in data blocks in data elements, where a map within a data element stores the association of a data block

within the data element to a stamp that indicates when the data in the data block was written. Thus, the maps in data elements can be used to generate the image of primary data volume 112 at a specified point-in-time. In step 504 (FIG. 5), the generated image of primary data volume .112 is used to restore primary data volume 112 on data storage device 110... If the entire primary data volume 112 needs to be restored, such as if data storage device 110 has failed, then the data associated with the generated image of primary data volume 112 can be restored from data storage device 120" (Paragraphs 30-31). The examiner further notes that **Rand** teaches **"modifying data of the first data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T"** as "Additionally, while the primary data volume is being restored, read/write requests to the primary data volume are satisfied using the generated image of the primary data volume" (Paragraph 6), "In step 506 (FIG. 5), while the primary data volume 112 is being restored, read and write requests for data in primary data volume 112 that have not been restored are satisfied using the generated image of primary data volume 112. For example, if host system 102 issues a read request for data that has not yet been restored to primary data volume 112, then the read request is satisfied by using the generated image of primary data volume 112" (Paragraph 32, and "In step 602, a determination is made as to whether the data storage drive having the primary data volume is active. If the data storage device is not active, then in step 604, the read/write requests to the primary data volume are satisfied using the generated image of the primary data volume" (Paragraph 35).

Rand does not explicitly teach:

C) wherein the first data volume is unrelated to the second data volume prior to refreshing the second data volume to the data contents of the first data volume.

Milillo, however, teaches **"wherein the first data volume is unrelated to the second data volume prior to refreshing the second data volume to the data contents of the first data volume"** as "In a PPRC system, volume pairs are designated in which a storage volume in the primary system is paired with a storage volume in the secondary system, which together may be referred to as an established PPRC volume pair" (Column 5, lines 56-60).

The examiner further note that it is common knowledge that in order for a PPRC volume pair to have volumes which become linked to one another, the volumes were initially unlinked to one another.
It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Milillo's** would have allowed **Rand's** to provide an improved system for improving the control for data synchronization, as noted by **Milillo** (Column 3, lines 41-48).

Regarding claim 30, **Rand** further teaches a method comprising:
A) modifying data of the second data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T (Paragraph 35);
B) wherein, in response to the modifying the second data volume, the second data volume becomes a modified point-in-time copy of the first data volume that existed at time T (Paragraph 35).

The examiner notes that **Rand** teaches **"modifying data of the second data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T"** as "FIG. 6 depicts in more detail an exemplary process 600 of satisfying read and write requests to primary data volume 112 while the primary data volume 112 is being restored. In step 602, a determination is made as to whether the data storage drive having the primary data volume is active. If the data storage device is not active, then in step 604, the read/write requests to the primary data volume are satisfied using the generated image of the primary data volume. If the data storage device is active, then in step 606, a determination is made as to whether the request is a write request. If the request is a write request, then in step 608 the write request is satisfied by the primary data volume" (Paragraph 35). The examiner further notes that **Rand** teaches **"wherein, in response to the modifying the second data volume, the second data volume becomes a modified point-in-time copy of the first data volume that existed at time T"** as "FIG. 6 depicts in more detail an exemplary process 600 of satisfying read and write requests to primary data

volume 112 while the primary data volume 112 is being restored. In step 602, a determination is made as to whether the data storage drive having the primary data volume is active. If the data storage device is not active, then in step 604, the read/write requests to the primary data volume are satisfied using the generated image of the primary data volume. If the data storage device is active, then in step 606, a determination is made as to whether the request is a write request. If the request is a write request, then in step 608 the write request is satisfied by the primary data volume" (Paragraph 35).

Regarding claim 31, **Rand** further teaches a computer readable medium comprising:

A) modifying data of the second data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T (Paragraph 35);

B) wherein, in response to the modifying the second data volume, the second data volume becomes a modified point-in-time copy of the first data volume that existed at time T (Paragraph 35).

The examiner notes that **Rand** teaches **"modifying data of the second data volume while the second data volume is being refreshed to the data contents of the first data volume that existed at time T"** as "FIG. 6 depicts in more detail an exemplary process 600 of satisfying read and write requests to primary data volume 112 while the primary data volume 112 is being restored. In step 602, a determination is made as to whether the data storage drive having the primary data volume is active. If the data storage device is not active, then in step 604, the read/write requests to the primary data volume are satisfied using the generated image of the primary data volume. If the data storage device is active, then in step 606, a determination is made as to whether the request is a write request. If the request is a write request, then in step 608 the write request is satisfied by the primary data volume" (Paragraph 35). The examiner further notes that **Rand** teaches **"wherein, in response to the modifying the second data volume, the second data volume becomes a modified point-in-**

time copy of the first data volume that existed at time T" as "FIG. 6 depicts in more detail an exemplary process 600 of satisfying read and write requests to primary data volume 112 while the primary data volume 112 is being restored. In step 602, a determination is made as to whether the data storage drive having the primary data volume is active. If the data storage device is not active, then in step 604, the read/write requests to the primary data volume are satisfied using the generated image of the primary data volume. If the data storage device is active, then in step 606, a determination is made as to whether the request is a write request. If the request is a write request, then in step 608 the write request is satisfied by the primary data volume" (Paragraph 35).

8. Claims 4-5, 8-12, 18-19, and 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rand et al.** (U.S. PGPUB 2005/0108302) in view of **Milillo et al.** (U.S. Patent 6,643,671) as applied to claims 1, 15, 31, and 32, and in view of **Veritas** (Article entitled "Veritas Flashsnap Point-in-Time Copy Solutions", dated 06/24/2002).

9. Regarding claim 4, **Rand** and **Milillo** do not explicitly teach a method comprising: A) creating one or more PIT copies of the first data volume prior to refreshing the second data volume to the data contents of the first data volume.

Veritas, however, teaches **"creating one or more PIT copies of the first data volume prior to refreshing the second data volume to the data contents of the first data volume"** as "1. Create snapshot mirrors: Use vxassist snapstart to create snapshot mirrors of one or more volumes" (Page 10, Section: Implementing Point-in Time Copy Solutions on a Primary Host).

The examiner notes that it is clear that **Veritas** creates multiple mirrors of primary volumes before refreshing the primary volume onto a secondary volume.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 5, **Rand** and **Milillo** do not explicitly teach a method comprising: A) wherein one of the PIT copies of the first data volume is in a virtual state when the second data volume is refreshed to the data contents of the first data volume.

Veritas, however, teaches **"wherein one of the PIT copies of the first data volume is in a virtual state when the second data volume is refreshed to the data contents of the first data volume"** as "The presence of the FastResync map means that only those updates that the mirror has missed need to be reapplied to resynchronize it with the volume. A full, and thereby much slower, resynchronization of the mirror form the volume is unnecessary" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** snapshot mirrors are virtual in that they contain data stored in the primary volume (see only updated data is migrated to the mirror for resynchronization). The examiner further notes that it is common knowledge that Flashsnap creates virtual point-in-time copies of volumes.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 8, **Rand** and **Milillo** do not explicitly teach a method comprising: A) wherein the first data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume.

Veritas, however, teaches **"wherein the first data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume"** as "1. Create snapshot mirrors: Use vxassist snapstart to create snapshot mirrors of one or more volumes...Use vxassist snapshot to create snapshot volumes from the snapshot mirrors" (Page 10, Section: Implementing Point-in Time Copy Solutions on a Primary Host).

The examiner notes that it is clear that **Veritas** has the snapshot volume refreshed to the state of the snapshot mirror, wherein the snapshot mirror is a point-in-time copy of the volume.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 9, **Rand** does not explicitly teach a method comprising:
A) wherein the second data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume.

Milillo, however, teaches **"wherein the second data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume"** as "In a PPRC system, volume pairs are designated in which a storage volume in the primary system is paired with a storage volume in the secondary system, which together may be referred to as an established PPRC volume pair" (Column 5, lines 56-60).

The examiner further note that it is common knowledge that in order for a PPRC volume pair to have volumes which become linked to one another, the volumes were initially unlinked to one another.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Milillo's** would have allowed **Rand's** to provide an improved system for improving the control for data synchronization, as noted by **Milillo** (Column 3, lines 41-48).

Regarding claim 10, **Rand** and **Milillo** do not explicitly teach a method comprising:
A) generating first and second maps in memory;
B) wherein each of the first and second maps comprises a plurality of entries;

C) wherein each entry of the first map corresponds to a respective memory block that stores data of the first data volume; and
D) wherein each entry of the second map corresponds to a respective memory block that stores data of the second data volume.

Veritas, however, teaches **"generating first and second maps in memory"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), **"wherein each of the first and second maps comprises a plurality of entries"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), **"wherein each entry of the first map corresponds to a respective memory block that stores data of the first data volume"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), and **"wherein each entry of the second map corresponds to a respective memory block that stores data of the second data volume"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** maps have a plurality of entries and track changes to both the primary volume and the snapshot volume (see "keep track of which blocks are updated in the volume and in the snapshot").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve

efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 11, **Rand** and **Milillo** do not explicitly teach a method comprising:

A) setting a first bit in each entry of the first map, wherein each first bit of the first map is set to indicate its respective memory block stores valid data;

B) clearing a first bit in each entry of the second map, wherein each first bit of the second map is set to indicate its respective memory block stores invalid data.

Veritas, however, teaches **"setting a first bit in each entry of the first map, wherein each first bit of the first map is set to indicate its respective memory block stores valid data"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), and **"clearing a first bit in each entry of the second map, wherein each first bit of the second map is set to indicate its respective memory block stores invalid data"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** maps have a plurality of entries and track changes to both the primary volume and the snapshot volume (see "keep track of which blocks are updated in the volume and in the snapshot").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 12, **Rand** and **Milillo** do not explicitly teach a method comprising:

A) setting or clearing a second bit in each entry of the second map to indicate that its respective memory block stores data needed for a PIT copy of the second data volume.

Veritas, however, teaches **"setting or clearing a second bit in each entry of the second map to indicate that its respective memory block stores data needed for a PIT copy of the second data volume"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** maps have a plurality of entries and track changes to both the primary volume and the snapshot volume (see "keep track of which blocks are updated in the volume and in the snapshot").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 18, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) wherein the method further comprises creating one or more PIT copies of the first data volume prior to refreshing the second data volume to the data contents of the first data volume.

Veritas, however, teaches **"wherein the method further comprises creating one or more PIT copies of the first data volume prior to refreshing the second data volume to the data contents of the first data volume"** as "1. Create snapshot mirrors: Use vxassist snapstart to create snapshot mirrors of one or more volumes" (Page 10, Section: Implementing Point-in Time Copy Solutions on a Primary Host).

The examiner notes that it is clear that **Veritas** creates multiple mirrors of primary volumes before refreshing the primary volume onto a secondary volume.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 19, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) wherein one of the PIT copies of the first data volume is in a virtual state when the second data volume is refreshed to the data contents of the first data volume.

Veritas, however, teaches **"wherein one of the PIT copies of the first data volume is in a virtual state when the second data volume is refreshed to the data contents of the first data volume"** as "The presence of the FastResync map means that only those updates that the mirror has missed need to be reapplied to resynchronize it with the volume. A full, and thereby much slower, resynchronization of the mirror form the volume is unnecessary" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** snapshot mirrors are virtual in that they contain data stored in the primary volume (see only updated data is migrated to the mirror for resynchronization). The examiner further notes that it is common knowledge that Flashsnap creates virtual point-in-time copies of volumes.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 22, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) wherein the first data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume.

Veritas, however, teaches **"wherein the first data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume"** as "1. Create snapshot mirrors: Use vxassist snapstart to create snapshot mirrors of one or more volumes...Use vxassist snapshot to create snapshot volumes from the snapshot mirrors" (Page 10, Section: Implementing Point-in Time Copy Solutions on a Primary Host).

The examiner notes that it is clear that **Veritas** has the snapshot volume refreshed to the state of the snapshot mirror, wherein the snapshot mirror is a point-in-time copy of the volume.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 23, **Rand** does not explicitly teach a computer readable medium comprising:

A) wherein the second data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume.

Milillo, however, teaches **"wherein the second data volume is a real or virtual PIT copy of another data volume when the second data volume is refreshed to the data contents of the first data volume"** as "In a PPRC system, volume pairs are designated in which a storage volume in the primary system is paired with a storage volume in the secondary system, which together may be referred to as an established PPRC volume pair" (Column 5, lines 56-60).

The examiner further note that it is common knowledge that in order for a PPRC volume pair to have volumes which become linked to one another, the volumes were initially unlinked to one another.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Milillo's** would have allowed **Rand's** to provide an improved system for improving the control for data synchronization, as noted by **Milillo** (Column 3, lines 41-48).

Regarding claim 24, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) wherein refreshing the second data volume further comprises generating first and second maps in memory;

B) wherein each of the first and second maps comprises a plurality of entries;

C) wherein each entry of the first map corresponds to a respective memory block that stores data of the first data volume; and

D) wherein each entry of the second map corresponds to a respective memory block that stores data of the second data volume.

Veritas, however, teaches **"wherein refreshing the second data volume further comprises generating first and second maps in memory"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), **"wherein each of the first and second maps comprises a plurality of entries"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), **"wherein each entry of the first map corresponds to a respective memory block that stores data of the first data volume"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume

Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), and **"wherein each entry of the second map corresponds to a respective memory block that stores data of the second data volume"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** maps have a plurality of entries and track changes to both the primary volume and the snapshot volume (see "keep track of which blocks are updated in the volume and in the snapshot").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 25, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) clearing a first bit in each entry of- the first map, wherein each first bit of the first map is set to indicate its respective memory block stores valid data;

B) setting a first bit in each entry of the second map, wherein each first bit of the second map is set to indicate its respective memory block stores invalid data.

Veritas, however, teaches **"clearing a first bit in each entry of- the first map, wherein each first bit of the first map is set to indicate its respective memory block stores valid data"** as "VxVM uses a FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots), and **"setting a first bit in each entry of the second map, wherein each first bit of the second map is set to indicate its respective memory block stores invalid data"** as "VxVM uses a

FastResync map to keep track of which blocks are updated in the volume and in the snapshot" (Page 7, Section: FastResync of Volume Snapshots) and "Non=-Persistent FastResync stores its change maps in memory" (Page 7, Section: FastResync of Volume Snapshots).

The examiner notes that it is clear that **Veritas's** maps have a plurality of entries and track changes to both the primary volume and the snapshot volume (see "keep track of which blocks are updated in the volume and in the snapshot").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's** and **Milillo's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

10. Claims 6, 13, 20, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rand et al.** (U.S. PGPUB 2005/0108302) in view of **Milillo et al.** (U.S. Patent 6,643,671) as applied to claims 1, 15, 31, and 32, and in view of **DeKoning** (U.S. Patent 6,691,245).

11. Regarding claim 6, **Rand** and **Milillo** do not explicitly teach a method comprising: A) further comprising an act of preserving the second data volume, wherein said preserving comprises creating one or more PIT copies of the second data volume prior to refreshing the second data volume to the data contents of the first data volume.

DeKoning, however, teaches **"further comprising an act of preserving the second data volume, wherein said preserving comprises creating one or more PIT copies of the second data volume prior to refreshing the second data volume to the data contents of the first data volume"** as "An incremental snapshot of the mirrored data is generated on the secondary storage device at the predetermined checkpoint indicated by the checkpoint message...Thus, the incremental snapshot maintains the storage state of the secondary storage device at the predetermined checkpoint" (Column 2, lines 59-67-Column 3, lines 10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching

DeKoning's would have allowed **Rand's** and **Milillo's** to improve efficiency in dealing with synchronization through volume preservation, as noted by **DeKoning** (Column 2, lines 1-5).

Regarding claim 13, **Rand** and **Milillo** do not explicitly teach a method comprising:

A) further comprising an act of preserving the second data volume, wherein said preserving comprises creating a PIT copy of the second data volume before or while refreshing the second data volume to the data contents of the first data volume.

DeKoning, however, teaches **"further comprising an act of preserving the second data volume, wherein said preserving comprises creating a PIT copy of the second data volume before or while refreshing the second data volume to the data contents of the first data volume"** as "An incremental snapshot of the mirrored data is generated on the secondary storage device at the predetermined checkpoint indicated by the checkpoint message...Thus, the incremental snapshot maintains the storage state of the secondary storage device at the predetermined checkpoint" (Column 2, lines 59-67-Column 3, lines 10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **DeKoning's** would have allowed **Rand's** and **Milillo's** to improve efficiency in dealing with synchronization through volume preservation, as noted by **DeKoning** (Column 2, lines 1-5).

Regarding claim 20, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) further comprising an act of preserving the second data volume, wherein said preserving further comprises creating one or more PIT copies of the second data volume prior to refreshing the second data volume to the data of the first data volume.

DeKoning, however, teaches **"wherein said preserving further comprises creating one or more PIT copies of the second data volume prior to refreshing the**

second data volume to the data of the first data volume" as "An incremental snapshot of the mirrored data is generated on the secondary storage device at the predetermined checkpoint indicated by the checkpoint message...Thus, the incremental snapshot maintains the storage state of the secondary storage device at the predetermined checkpoint" (Column 2, lines 59-67-Column 3, lines 10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **DeKoning's** would have allowed **Rand's** and **Milillo's** to improve efficiency in dealing with synchronization through volume preservation, as noted by **DeKoning** (Column 2, lines 1-5).

Regarding claim 26, **Rand** and **Milillo** do not explicitly teach a computer readable medium comprising:

A) further comprising an act f preserving the second data volume, wherein said preserving further comprises creating a PIT copy of the second data volume before or while refreshing the second data volume to the data of the first data volume.

DeKoning, however, teaches **"further comprising an act f preserving the second data volume, wherein said preserving further comprises creating a PIT copy of the second data volume before or while refreshing the second data volume to the data of the first data volume"** as "An incremental snapshot of the mirrored data is generated on the secondary storage device at the predetermined checkpoint indicated by the checkpoint message...Thus, the incremental snapshot maintains the storage state of the secondary storage device at the predetermined checkpoint" (Column 2, lines 59-67-Column 3, lines 10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **DeKoning's** would have allowed **Rand's** and **Milillo's** to improve efficiency in dealing with synchronization through volume preservation, as noted by **DeKoning** (Column 2, lines 1-5).

12. Claims 7 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rand et al.** (U.S. PGPUB 2005/0108302) in view of **Milillo et al.** (U.S. Patent 6,643,671) as applied to claims 1, 15, 31, and 32, and in view of **DeKoning** (U.S. Patent 6,691,245) as applied to claims 6, 13, 20, and 26, and in view of **Veritas** (Article entitled "Veritas Flashsnap Point-in-Time Copy Solutions", dated 06/24/2002).

13. Regarding claim 7, **Rand**, **Milillo**, and **DeKoning** do not explicitly teach a method comprising:

A) wherein one of the PIT copies of the second data volume is in the virtual state when the second data volume is refreshed to the data contents of the first data volume.

Veritas, however, teaches **"wherein one of the PIT copies of the second data volume is in the virtual state when the second data volume is refreshed to the data contents of the first data volume"** as "1. Create snapshot mirrors: Use vxassist snapstart to create snapshot mirrors of one ore more volumes...Use vxassist snapshot to create snapshot volumes from the snapshot mirrors" (Page 10, Section: Implementing Point-in Time Copy Solutions on a Primary Host).

The examiner notes that it is clear that **Veritas** has the snapshot volume refreshed to the state of the snapshot mirror, wherein the snapshot mirror is a point-in-time copy of the volume.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's**, **Milillo's**, and **DeKoning's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Regarding claim 21, **Rand**, **Milillo**, and **DeKoning** do not explicitly teach a computer readable medium comprising:

A) wherein one of the PIT copies of the second data volume is in the virtual state when the second data volume is refreshed to the data contents of the first data volume.

Veritas, however, teaches **"wherein one of the PIT copies of the second data volume is in the virtual state when the second data volume is refreshed to the data contents of the first data volume"** as "1. Create snapshot mirrors: Use vxassist snapstart to create snapshot mirrors of one ore more volumes...Use vxassist snapshot to create snapshot volumes from the snapshot mirrors" (Page 10, Section: Implementing Point-in Time Copy Solutions on a Primary Host).

The examiner notes that it is clear that **Veritas** has the snapshot volume refreshed to the state of the snapshot mirror, wherein the snapshot mirror is a point-in-time copy of the volume.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of the cited references because teaching **Veritas's** would have allowed **Rand's**, **Milillo's**, and **DeKoning's** to provide a method to improve efficiency in resynchronization by applying changes to only the updates a mirror has missed, as noted by **Veritas** (Page 7, Section: FastResync of Volume Snapshots).

Response to Arguments

14. Applicant's arguments with respect to claims 1, 4-13, 15, and 18-26 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 6,665,815 issued to **Goldstein et al.** on 16 December 2003. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

U.S. Patent 6,611,901 issued to **Micka et al.** on 26 August 2003. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

U.S. Patent 6,799,258 issued to **Linde et al.** on 28 September 2004. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

U.S. Patent 5,875,479 issued to **Blount et al.** on 23 February 1999. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

U.S. Patent 6,338,114 issued to **Paulsen et al.** on 08 January 2002. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

Article entitled "VERITAS FlashSnap: Using VERITAS FlashSnap to Protect Application Performance and Availability, by: **VERITAS**, dated 05/14/2002. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

Article entitled "VERITAS FlashSnap: Guidelines for Using VERITAS FlashSnap, by: **VERITAS**, dated 05/01/2002. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

U.S. Patent 7,085,901 issued to **Homma et al.** on 01 August 2006. The subject matter disclosed therein is pertinent to that of claims 1, 4-13, 15, 18-26, and 30-31 (e.g., methods to spur synchronization via snapshots amongst varied data volumes).

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahesh Dwivedi whose telephone number is (571) 272-2731. The examiner can normally be reached on Monday to Friday 8:20 am – 4:40 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Gaffin can be reached (571) 272-4146. The fax number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mahesh Dwivedi
Patent Examiner
Art Unit 2168

May 04, 2007

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